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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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Development of USES Aptitude Test Battery for Assembler, Accessories

(elec. equip.; electronics) 729.887

U.S. DEPARTMENT OF LABOR

MANPOWER ADMINISTRATION

ED 068545

Technical Report on Development of USES Aptitude Test Battery

For . . . .

Assembler, Accessories (elec. equip.; electronics) 729.887

S-414

(Developed in Cooperation with the
Virginia Employment Commission)

U.S. DEPARTMENT OF LABOR
Willard Wirtz, Secretary

MANPOWER ADMINISTRATION
Stanley H. Ruttenberg,
Administrator

BUREAU OF EMPLOYMENT SECURITY
Robert C. Goodwin, Administrator

U.S. EMPLOYMENT SERVICE
Charles E. Odell,
Director

June 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell

Charles E. Odell, Director
U. S. Employment Service

GATB Study #2664

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Assembler, Accessories (elec. equip.; electronics) 729.887

S-414

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Assembler, Accessories (elec. equip.; electronics) 729.887. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
Q - Clerical Perception	100
K - Motor Coordination	100
F - Finger Dexterity	80

RESEARCH SUMMARY

Sample:

55 employed females (17 experienced workers and 38 applicants hired between March 1967 and June 1967) employed as Assemblers, Small Parts at Stackpole Components Company, Farmville, Virginia.

Criterion:

Supervisory ratings.

Design:

Longitudinal. Most of the data was gathered on a longitudinal basis. However, a portion of the data was gathered on a concurrent basis. Test data was collected at various times between March 1967 and June 1967. Criterion data for both samples was collected at the same time in August and September.

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi Coefficient = .36 (P/2 less than .005)

Effectiveness of Norms:

Only 62% of the non-test-selected workers used for this study were good workers; if workers had been test-selected with the above norms, 78% would have been good workers. 38% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 22% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	62%	78%
Poor Workers	38%	22%

SAMPLE DESCRIPTION

Size:

N = 55 (65% White, 35% Negro)

Occupational Status:

17 employed workers.
38 applicants.

Work Setting:

Workers were employed by Stackpole Components Company, Farmville, Virginia. Applicants included in sample were ultimately hired by company.

Employer Selection Requirements:

Education:
Minimum sixth grade education.
Previous Experience:
None.
Tests:
Must pass Factored Aptitude Series Tests, Industrial Psychology Inc. with total weight of twelve. (Edition A consisting of TOOLS, PRECISION, BLOCKS and DEXTERITY. MOTOR is not administered, a weight of 5 is added for each applicant and is included in total weight of 12.)
Other:
Meet weight requirements in accordance to height.
Pass company physical and eye test.
Personal interview and reference check.

Principal Activities:

The job duties for each worker in the final sample are comparable to those in the job description in the Appendix.

Minimum Experience:

All workers in the sample had a minimum of two months experience at the time criterion data was obtained.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	27.3	7.93	18-44	-.221
Education (years)	10.4	1.77	6-12	-.004
Experience (months)	7.6	5.38	2-17	.002

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered during the period March 1967 through June 1967.

CRITERION

The criterion data consisted of pooled supervisory ratings made by first and second line supervisors on USES Form SP-21, "Descriptive Rating Scale." Workers were rated after they had been on the job at least two months. Ratings and reratings were at least two weeks apart.

Rating Scale:

Form SP-21, "Descriptive Rating Scale", was used. The scale (see Appendix) consisted of nine items covering different aspects of job performance. Each item had five alternatives covering different degrees of job proficiency.

Reliability:

A correlation coefficient between the two sets of ratings of .80 was obtained, indicating satisfactory reliability. The final criterion score consisted of the combined scores of the two sets of ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	35-77
Mean:	52.31
Standard Deviation:	9.57

Criterion Dichotomy:

The criterion distribution was dichotomized into high and low groups by placing 38% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low criterion group as "poor workers". The criterion critical score was ~~52~~ 49.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of the qualitative analysis of the job duties involved and a statistical analysis of test and criterion data. Aptitudes Q, K and M which do not have a high correlation with the criterion were considered for inclusion in the norms because the qualitative analysis indicated that these aptitudes were important for the job duties, with Aptitude K considered critical; and the sample had a relatively high mean on those aptitudes. In addition, Aptitude Q also had a relatively low standard deviation. The company tests used for pre-selection of the sample would account for the relatively high mean scores. This pre-selection would restrict the range of scores (low standard deviation) and depress the correlation between the aptitude and the criterion. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the Aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
P - Form Perception	To assemble piece goods of various size and shape in specified relationship to each other; to perceive pertinent detail of visual demonstration; to visually inspect sub or final assembly to see that machine is operating properly.
Q - Clerical Perception	To perceive pertinent detail in verbal instructions from group leader, Piece parts are fitted together in sequence.
K - Motor Coordination	Necessary for assembling piece parts; positioning of piece parts in jigs or fixtures; and operating various machines swiftly and accurately.
F - Finger Dexterity	Necessary for manipulating small parts to position in specified relationship to each other and to position in jigs or fixtures swiftly and accurately.
M - Manual Dexterity	Necessary for operating various machines and use of small hand tools in bench assembly of piece parts.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 55.

Aptitude	Mean	SD	Range	r
G - General Learning Ability	88.98	13.42	62-117	.283*
V - Verbal Aptitude	90.29	12.06	70-131	.096
N - Numerical Aptitude	91.71	16.20	58-119	.196
S - Spatial Aptitude	94.31	15.62	58-130	.340*
P - Form Perception	109.00	16.31	83-150	.158
Q - Clerical Perception	110.62	14.29	86-138	.094
K - Motor Coordination	114.82	19.40	72-155	.152
F - Finger Dexterity	102.16	19.03	62-142	.357**
M - Manual Dexterity	115.98	20.08	69-153	.236

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important					X	X	X*	X*	X
Irrelevant		0	0						
Relatively High Mean						X	X		X
Relatively Low SD	X	X				X			
Significant Correlation with Criterion	X			X				X	
Aptitudes to be Considered for Trial Norms	G			S		Q	K*	F*	M

*Aptitudes considered critical for performance of job.

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, S, Q, K, F and M at trial cutting scores were able to differentiate between the 62% of the sample considered good workers and the 38% of the sample considered poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly higher than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores of slightly lower than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of Q-100, K-100 and F-80 provided the highest degree of differentiation for the occupation of Assembler, Accessories (elec. equip.; electronics) 729.887 These norms are shown in Table 6 and are indicated by a Phi Coefficient of .36 (statistically significant at the .005 level).

TABLE 6

Predictive Validity of Test Norms Q-100, K-100 and F-80

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	25	34
Poor Workers	14	7	21
Total	23	32	55

Phi Coefficient ($\emptyset$) = .36 Chi Square(X^2_y) = 7.0
Significant Level = P/2 less than .005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings in the development of new occupational aptitude patterns.

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score_____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters," and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male _____ Female _____

Company Job Title: _____

How often do you see this worker in a work situation?

- ☐ See him at work all the time.
- ☐ See him at work several times a day.
- ☐ See him at work several times a week.
- ☐ Seldom see him in work situation.

How long have you worked with him?

- ☐ Under one month.
- ☐ One to two months.
- ☐ Three to five months.
- ☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low work output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

- ☐ 1. Performance is inferior and almost never meets minimum quality standards.
- ☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.
- ☐ 3. Performance is acceptable but usually not superior in quality.
- ☐ 4. Performance is usually superior in quality.
- ☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

- ☐ 1. Makes very many mistakes. Work needs constant checking.
- ☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.
- ☐ 3. Makes mistakes occasionally. Work needs only normal checking.
- ☐ 4. Makes few mistakes. Work seldom needs checking.
- ☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-round" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

SP-21
Rev. 2/61

I. Considering all the factors already rated...how acceptable is his work? (continued)

3. A fairly proficient worker. Performance generally acceptable.

4. A valuable worker. Performance usually superior.

5. An unusually competent worker. Performance almost always top notch.

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FACT SHEET

Job Title: Assembler, Accessories (elec. equip.; electronics) 729.887-005

Job Summary: Assembles and fastens small component parts and sub-assemblies together to make a variety of slide switches, line switches and variable resistors for the electrical and electronic industries; using such equipment as drill presses, kick presses, power presses, riveting machines, slide crimpers, spot welders, and small hand tools.

Work Performed: Assembles and fastens a variety of component parts and sub-assemblies to make switches and variable resistors: Receives oral instructions and a visual demonstration of the sequence the parts are fitted and fastened together for each work order. Assembles small parts and/or sub-assemblies in hands and/or jigs or fixtures on machine preparatory to fastening operation. May assemble and fasten parts using tweezers and small hand tools to make sub-assemblies. May apply lubricant to parts by hand or using grease gun mounted at work station. Fastens parts and/or sub-assemblies using equipment set-up by others such as drill presses, kick presses, power presses, riveting machines, slide crimpers, and spot welders. Removes assembly from jig or fixture; inspects to see if machine is operating properly and places assembly in tray to be transported to next work station. Records product code and customer order number from identification card, quantity assembled from counter on machine, and the starting and finishing time for each work order on time card so that accounting department can figure unit costs. Makes a duplicate identification card as necessary and places in trays of completed assemblies.

GPO 860,995

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